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ABSTRACTS OF THE 1991 CONFERENCE ON VERTEBRATE PALAEONTOLOGY, EVOLUTION AND SYSTEMATICS, ALICE SPRINGS, NT, MARCH 28-30

Title: EVOLUTION OF THE AUSTRALIAN AND ANTARCTIC VEGETATION DURING THE TERTIARY

By: **Robert S. Hill.**

Department of Plant Science, University of Tasmania.

Interpretation of plant fossils traditionally splits into two camps; those concerned with 'microfossils' (e.g. pollen and spores) and those concerned with 'macrofossils' (or 'megafossils', e.g. wood, leaves, reproductive structures). It is also traditionally accepted that whereas microfossils provide the general picture of past vegetation, macrofossils generally provide higher taxonomic resolution but represent vegetation from a very restricted area. This dichotomy is currently breaking down in Australia as it is realised that Tertiary vegetation was very complex and the old views of a Tertiary landscape covered for most of the time with widespread and uniform rainforest are fast disappearing.

In Australia it is clear that macro- and microfossil data, or a combination of the two, can be used for many purposes; e.g.

1. **Reconstruction of vegetation.** At present this is probably best illustrated by the complex Early Tertiary rainforests of Tasmania.
2. **Determination of primary and secondary factors in plant evolution.** For example, the sclerophyll elements in Australian rainforests almost certainly evolved primarily in response to low soil nutrients, with low water availibility being a secondary problem.
3. **Determination of evolution in response to climate change.** Two key Australian plant families, the Fagaceae and Podocarpaceae, provide excellent evidence of long term evolution in response to declining temperature and changing rainfall patterns.
4. **Leaf form (physiognomy) provides independent evidence of vegetation type and climate.**
5. **The presence of certain taxa provide evidence of absolute climatic limits.** For example, *Nothofagus* leaves in the Antarctic Pliocene place limits on the minimum prevailing temperatures because of their known temperature requirements for survival (during winter) and their growth and reproduction (during summer).

Palaeobotanical research is on the verge of providing a new interpretation of the evolution of the Australian vegetation - the complexity of the emerging data suggests a Tertiary history of diversity, adaptability and regionalism every bit as complex as that which occurs today.

Title: PRIMITIVE MACROPODIDS FROM THE MIOCENE FRESHWATER LIMESTONE DEPOSITS OF RIVERSLEIGH, NORTHWESTERN QUEENSLAND

By: **Bernard N. Cooke.**

School of Life Sciences, Queensland University of Technology.

Three new species, *Ganawamaya acris* n. gen. and sp., *G. ornata* n. sp. and *G. acdiculus* n. sp. are described from the early to mid Miocene limestone deposits of Riversleigh, northwestern Queensland. I_1 morphology seen in this genus is similar to that reported in undescribed species from the Kutjumarpu Local fauna and may represent a synapomorphy for Balbarinae. Molar morphology of the species of the species of *Ganawamaya* is intermediate between the known species of *Nambaroo* and those of *Balbaroo*. Deep penetration of the masseteric canal within the mandible, as seen in *G. acris* and *G. acdiculis* and known to occur in other Riversleigh balbarine species, is suggested as a potential macropodoid synapomorphy.

Title: **UNIQUE MARSUPIAL TOOTH REPLACEMENT/FUNCTION IN *Ekaltadeta ima*, AN OLIGO-MIOCENE POTOROID KANGAROO FROM RIVERSLEIGH, NORTHWESTERN QUEENSLAND.**

By: **Steven Wroe.**

School of Biological Sciences, University of NSW.

One of the synapomorphies of marsupials is that M1 is displaced by the erupting P3. One of the synapomorphies of kangaroos (Macropodoidea) is that P3 displaces P2 as well as M1. In hypsiprymnodontine pororoids, alone among previously known macropodoids, P2 may persist for a while after eruption of P3 but it is lost in the adult dentition. Further, P2 changes its position along the toothrow following eruption of P3. In the juvenile dentition , P2 provides a sectorial blade that functions in consort with the compressed trigonid of M1. In the adult dentition, the P2 actually drops well below the occlusal plane but, instead of being lost, re-establishes against the anterior root of P3, within the eruption alveolus of P3, where it takes on a completely different function: butress support for the massive sectorial P3 much in the manner of multituberculates and some specialised placentals. Although P2 retains its basic morphology in the adult dentition, its crown - which does not occlude with any other crown - no longer functions as a sectorial blade. In all specimens recovered so far, this change appears to occur in both the upper and lower dentition. Whether this butress persists late in life is as yet unknown because no old adult specimens have been found. Such a fundamental alteration of position and function for a tooth, within an individual's lifetime, may be unique among mammals.

Title: **ENAMEL ULTRASTRUCTURE OF THE TINGAMARRA FOSSILS.**

By: **Coral Gilkeson.**

Education Centre, Westmead Hospital Dental Clinic School.

Fracture enamel surfaces of a diverse array of teeth, tentatively identified as marsupial, from the Tingamaara deposit have been examined in the scanning electroscope. Marsupial affiliation is indicated for some specimens on the basis of prism packing pattern, parallelism and simplicity of prism course and tubule presence. In other specimens, the presence of pseudoprisms suggests less developed enamel in the evolutionary sense. This feature, along with a reduced tubule presence in some specimens, makes marsupial affiliation unclear. The affinities of these enamels to those of any previously known marsupial family, as yet, cannot be determined with confidence.

Title: **WOMBAT-LIKE MARSUPIALS FROM THE OLIGO-MIOCENE FAUNAL ASSEMBLAGES OF RIVERSLEIGH**

By: **Michael Archer* and Henk Godthelp.**

School of Biological Sciences, University of NSW.
*speaker

Vombatimorphian groups represented in the Oligo-Miocene assemblages of Riversleigh include diprotodonts, palorchestids, wynyardiids, thylacoleonids and ilariids. There are also several vombatimorphian taxa that appear to represent groups distinct at the family level. Although vombatids as such were not clearly represented in these assemblages, several wombat-like groups appear to represent close relatives. At least one of these, from Boid Site East, represented by partial skull with dentition, is relatively unspecialised. But another, represented for example in the Upper Site Local Fauna, known at first only from unworn molar caps and jaw fragments, suggested a specialised group with doubtful relationships to vombatids. Comparisons with the previously oldest-known vombatid, *Rhizophascolonus crowcrofti*, from the early to middle Miocene Kutjamarpu Local Fauna of central Australia, were limited by the worn condition of the type specimen (an isolated premolar; although we have since collected two worn molars of this taxon from the type locality).

However, highly hypsodont teeth with unworn as well as worn crowns, obtained from Cleft of Ages and Encore Sites discovered in 1990, suggest that at least some of Riversleigh material may represent a *Rhizophascolonus*-type animal. If so, it is the first vombatid material to come from Riversleigh's Tertiary deposits and the only taxon to suggest the presence of abrasive plant materials in these ecosystems. Crown morphology of this taxon is phylogenetically informative and provides important information about the affinities of these earliest wombats.

Title: **THE SMALLEST ZYGOMATURINES - DERIVED DWARF OR PLESIOMORPHIC PYGMY**

By: **Peter F. Murray*[1] and P. Walker[2].**

[1] NT Museum, Alice Springs.
[2] University of California, Santa Barbara.
* speaker

Pig-sized New Guinea Pleistocene zygomaturines are the smallest diprotodontids known. The proportional features of *Hulitherium*, the only formally designated Pleistocene New Guinea zygomaturine, have been considered to be plesiomorphic, as opposed to allometric distortions related to a marked reduction in body size. The Santa Barbara zygomaturine closely resembles the Australian Pleistocene *Zygomaturus trilobus*, sharing its most distinctive derived features such as the presence of nasal tuberosities, hypertrophied frontal crests, deflected cranial base, and deep, massive zygomatic arches and processes. Small, late Miocene zygomaturines such as *Kolopsis torus* lack these features. It is therefore concluded that the Santa Barbara zygomaturine is a derived 'dwarfed' species of *Zygomaturus*.

Title: **AN EARLY TERTIARY BAT FROM THE TINGAMARRA LOCAL FAUNA OF SOUTHEASTERN QUEENSLAND**

By: **S. Hand*[1], H. Godthelp[1], M.J. Novacek[2] and M. Archer[1].**

[1] School of Biological Sciences, University of NSW.
[2] Department of Vertebrate Paleontology, American Museum of Natural History.
* Speaker

A lower molar, upper premolar, edentulous dentary fragment and part of a periotic bone represent Australia's oldest bat. The remains, recovered from freshwater clays in southeastern Queensland, are believed to be approximately 55 million years old (Godthelp *et al.* submitted). Previously, early Eocene bats had been reported only from the Northern Hemisphere, and the oldest Australian fossil bats were from 25 million-year-old sediments in central Australia and northwestern Queensland. Like other early and middle Eocene bats, the Australian species has a primitive dentition and was probably capable of echolocation. The bat is referred to the suborder Microchiroptera and placed in its own genus; its familial identity is yet to be determined. The discovery puts bats in Australia much earlier than expected -before the final breakup of Gondwana.

Title: **RINGTAIL POSSUMS (PSEUDOCHEIRIDAE, MARSUPIALIA) FROM THE TERTIARY DEPOSITS OF RIVERSLEIGH.**

By: **Michael Archer.**

School of Biological Sciences, University of NSW.

The Oligo-Miocene faunal assemblages from Riversleigh contain a high diversity of arboreal marsupials including representatives of all groups of living possums (except tarsipedids) as well as many now extinct groups. Among petauroids, there are many pseudocheirids and petaurids as well as other taxa that do not fit into either of these two still extant families. Among extinct groups of

pseudocheirids, there are at least representatives of the genera *Pildra* and *Paljara* previously unknown outside of central Australia.

In addition, there are several species representing *Pseudocheirops*-like ringtails, the only known fossil representatives of this group (apart from an undescribed taxon in the Alcoota Local Fauna). Coming from the late Oligocene to middle Miocene local faunas of Riversleigh, these are the first pre-Pliocene representatives of any of the living groups of ringtail possums.

Species diversity of the pseudocheirids in individual faunal assemblages is very high, with up to nine species per local fauna. This diversity is well in excess of that found in any modern Australian/Papua New Guinean environment, and argues for high floral diversity in the area of middle Tertiary Australia.

The Pliocene Rackham's Roost Local Fauna from Riversleigh contains another pseudocheirid, but by the late Tertiary, arboreal marsupials appear to have been uncommon in the Riversleigh region. Today, the only pseudocheirid in the area is the Rock-haunting Ringtail, *Pseudocheirops dahli*.

Title: **TERTIARY BANDICOOTS**

By: **Jeanette Muirhead.**

School of Biological Sciences, University of NSW.

Within the late Oligocene to middle Miocene Riversleigh faunas, bandicoots are among the most frequently encountered mammals, second only to bats. The diversity of bandicoots is also large, representing a far greater number of taxa than in modern faunas. In contrast, morphological diversity is limited, ranging from very plesiomorphic forms not far removed from dasyuroid morphology, to generalist insectivore-omnivore types. No evidence of open grassland food types is reflected in the dentition of these Tertiary bandicoots. The appearance of species of *Perameles* in the Pliocene (e.g. the Early Pliocene *P. allinghamensis* and a new *Perameles* species from the Middle Pliocene Bow Local Fauna) supports the hypothesis of declining rainforest and increasing grasslands and heathlands by the early Pliocene. As a consequence of this change, there was a marked decline in perameloid diversity.

Title: **THICKHEADS, THINHEADS AND AIRHEADS - MORPHOLOGICAL TENDENCIES IN VOMBATIFORM CRANIA.**

By: **Peter F. Murray.**

NT Museum, Alice Springs.

Although a tendency for large cranial sinuses to form around the brain cavity in vombatimorphian marsupials is a well known condition, few attempts have been made to explain the phenomenon. Similar conditions are found in other mammals, but none have developed it to the extent seen in diprotodontid or palorchestine marsupials. Examination of a series of living and extinct diprotodontan crania suggests that the cranial inflation of vombatimorphian taxa is due to negative brain to body size allometry in combination with a unique pattern of differential growth between the facial and neurocranial components of the skull. The latter phenomenon is attributed to the marked difference in tooth replacement in marsupials and placentals.

Title: **ON *WARENDJA WAKEFIELDI* HOPE AND WILKINSON 1982, (MARSUPIALIA: VOMBATIDAE).**

By: **Neville Pledge.**

South Australian Museum, Adelaide.

The Pleistocene wombat genus *Warendja* was based on two dentaries and some isolated teeth from McEachern's Cave, western Victoria. Subsequently, a maxilla was described from near Comaum, South Australia (Flannery and Pledge 1987). Further work has uncovered more fragments associated with that maxilla, enough to make a partial reconstruction of the skull. This is long, narrow and lightly built and

supports some of the conjectures of Hope and Wakefield. It is, however, not particularly like *Trichosurus* in gross form, but more like a wynyardiid such as *Muramura*. Despite the plesiomorphic skull form, the relationship of bones in the otic region is distinctly wombat-like.

Title: **THE TYPE AND FIGURED COLLECTION (EXCLUDING PLANT FOSSILS) IN THE PALAEONTOLOGY SECTION OF THE AUSTRALIAN MUSEUM, WITH SPECIAL REFERENCE TO VERTEBRATES.**

By: **Robert Jones.**

Division of Earth Sciences, Australian Museum, Sydney.

The Australian Museum type fossil collection is an important resource to palaeontology. It has recently been enlarged by the incorporation of other type collections from universities within New South Wales. It aims to fulfil its obligations as recommended by the International Commission on Zoological Nomenclature and maintain its position as an important part of Australia's natural heritage.

Title: **AUSTRALIAN PLEISTOCENE MEGAFAUNA: WHEN AND WHERE.**

By: **Alexander Baynes.**

Western Australian Museum, Perth.

In order to assess the hypotheses that attempt to explain late Pleistocene megafaunal extinctions, it is necessary to have accurate estimates of the dates of the last occurence of each species in various parts of the continent (Grayson 1989). Such dates are likely to prove harder to determine in Australia than in North America, both because there are fewer sites and because, in some areas at least, the last dates are close to the practical limits of radiocarbon dating. Criteria developed by Metzler and Mead (1985) provide the means to rigorously separate reliable from unreliable radiocarbon dates. When these criteria are applied to radiocarbon dates from Western Australia they reveal that not only do we not have a date for extinction of any megafaunal element in W.A., but there is not a single reliable date for occurrence. Current evidence suggests that the megafauna (including koalas and wombats) became extinct in south-western Australia before 35 000 B.P. In south-eastern Australia, on the other hand, there are reliable dates for some taxa surviving until much later, e.g. *Sthenurus* at 16 000 B.P. in Seton rock shelter (Hope *et al.* 1977).

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Title: **DEMISE OF THE DANCING DINOSAURS**

By: **Tony Thulborn.**

Department of Zoology, University of Queensland.

Speed estimates derived from fossil trackways have recently been used to support the claim that dinosaurs were warm-blooded. The fullest treatment of those speed-estimates has been published by R.T. Bakker (1986) in an article titled 'The Return of the Dancing Dinosaurs'. In Bakker's estimation, 'fossil footprints show that the dinosaurs cruised at warm-blooded speeds'.

Comparisons of absolute speed are meaningless in the context of Bakker's discussion. Such comparisons would be meaningful only if they were expressed in terms of a standardized variable (e.g. dimensionless speed or relative stride length). Even then it would be unreasonable to assume that such a standardized variable must be correlated with thermal physiology; it might equally well (or better) be correlated with size, shape, locomotor anatomy or behaviour.

From simple inspection it seems that Bakker's data demonstrates nothing beyond the well-known relationship between body size and absolute speed amongst terrestrial animals in general. This relationship carries no implications for thermal physiology. In addition it must be noted that the speed-estimates derived from dinosaur trackways by Bakker are entirely consistent with those obtained by other researchers. Such speed-estimates can reveal nothing of warm-bloodedness or cold-bloodedness.

In summary, Bakker's argument about the physiological significance of dinosaur trackways is fundamentally flawed. There is no factual basis for his notion the 'dinosaurs cruised at warm-blooded speeds'.

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Title: **A NEW GENUS OF LARGE MADTSOIID SNAKES FROM OLIGO-MIOCENE DEPOSITS AT RIVERSLEIGH (QUEENSLAND) AND MIOCENE DEPOSITS AT BULLOCK CREEK (NORTHERN TERRITORY).**

By: **John Scanlon.**

School of Biological Sciences, University of NSW.

Disarticulated but associated collections of snake vertebrae can be referred to individual skeletons by size, proportions and features indicating regions within the column. Large remains from a single location at Bullock Creek (Blast Site) and several sites at Riversleigh (including Mike's Menagery, Camel Sputum and White Hunter amongst others) represent a new genus *Yurlungurr* and two new species of madtsoiid snakes distinct from the only other Australian madtsoiid described, *Wonambi naracoortensis* (Smith 1976). Material from Bullock Creek represents a single individual which possesses distinctively curled-up zygosphenes and zygantra in a region extending from near mid-body to a point anterior to the cloaca. This regional feature has not been observed in any material from the Riversleigh sites and is here regarded an autapomorphic condition defining the species *Yurlungurr sp. nov. A*. Riversleigh specimens are not known to possess any apomorphies with respect to *Y. sp. nov. A* but are generally similar to each other and are referred to *Yurlungurr sp. nov. B*. As well as vertebrae from most regions of the body and tail, the Riversleigh deposits also include ribs, jaw elements and a basisphenoid complex referrable to the same large species. These elements (also known from *W. naracoortensis*) support a view of Madtsooidae as a very early lineage within Alethinophidia, retaining many plesiomorphic features and distinct from all extant families of boa-like snakes.

Title: **SCINCID LIZARDS FROM RIVERSLEIGH: A PRELIMINARY REPORT**

By: **Mark N. Hutchinson.**

South Australian Museum, Adelaide.

The world's and Australia's largest family of lizards is the Scincidae, with over 1,000 described species in about 120 genera. The fossil record of the group is however poor and uninformative. Sorting of the fossils recorded over the last decade from the Tertiary deposits at Riversleigh, Queensland reveals a diverse fauna of scincids from the Oligo-Miocene to late Miocene, the richest yet reported anywhere. Almost all specimens sorted so far have been tooth-bearing bones, especially

dentaries, for which no significant body of published literature exists, making recognition of fossil specimens difficult. Three phylogenetic lineages are recognised in the modern skink fauna of Australia and all three have been found in early to middle Miocene sites. Of the three, the *Sphenomorphus* group is the best represented lineage, the *Egernia* is less abundant but still widespread, and the *Eugongylous* group is known only from a single certainly identified specimen. The presence of these groups in Australia thus dates at least to the Oligocene, implying that the conventional explanation of arrival from the north must have entailed significant island hopping and overwater dispersal. The alternative, that skinks are Gondwanan and diversified through vicariance, has not often been considered, but is not inconsistent with currently observed centres of skink endemism or with the evidence presented here.

Title: **EARLY HISTORY OF THE CRYPTODIRAN TURTLES IN AUSTRALIA**

By: **E.S. Gaffney*[1], L. Kool[2], T. Rich[3], P.V. Vickers-Rich[2], N. Pledge[4], M. Archer[5] and A. White[5].**

[1] American Museum of Natural History, New York.
[2] Monash University, Victoria.
[3] National Museum of Victoria, Melbourne.
[4] South Australian Museum, Adelaide.
[5] School of Biological Sciences, University of NSW.
* Speaker

Recent discoveries of a primitive cryptodire from the early Cretaceous of Victoria and a new taxon of horned turtles from the Miocene of Queensland open hitherto unknown chapters in the history of turtles.

Numerous specimens of an early Cretaceous cryptodire have been discovered in the Otway Group of Victoria by Rich, Rich and Kool. This undescribed new genus and species is most similar to a poorly known group of primitive eucryptodires, known as sinemydids or macrobaenids. The sinemydids are found in Asia and North America and are known from the Jurassic to the Paleogene. The absence of mesoplastra and plastral butresses, and the presence of formed cervical articulations and opisthcoelous caudals characterise the group, which has not yet been demonstrated to be monophyletic. At least some of the sinemydids are related to the living chelydrids or snapping turtles. The presence of a primitive non-marine cryptodire in the Australian Cretaceous corroborates the earlier suggestion of Gaffney (1983) that Australia would be expected to have a Mesozoic history of primitive cryptodires, as well as the marine cryptodires.

Megirian, Pledge, Archer and White and associated field workers have discovered two new taxa of horned turtle or meiolaniids in the Miocene of Queensland and Northern Territory. These new taxa show that two distinct lineages of meiolaniids were present in the Miocene: a group having recurved horns but no occipital shelf and a group without horns but with a well developed occipital shelf. This is consistent with the earlier suggestion that meiolaniids had been established in Australia at least in the Paleogene and probably in the Mesozoic.

Title: **NEW FINDS OF MESOZOIC REPTILES FROM WESTERN AUSTRALIA.**

By: **John Long.**

Western Australian Museum, Perth.

A large pterosaur bone from the Late Cretaceous Miria Formation, Carnarvon Basin, Western Australia was recently recognised from a fragmentary specimen in the W.A. Museum collections. It is a partial proximal ulna, and the presence of a ridge on the medial condyle on the proximal face suggests that it belongs to the family Azhdarchidae, making this the first record of the group in Australia. It is also Australia's largest flying animal with an estimated wingspan between 3.6 - 4.8 metres, based on comparisons with *Santadactylus*, *Quetzalcoatlus* and *Pteranodon*. It also represents

Australia's youngest terrestrial Mesozoic vertebrate fauna (Bennett and Long 1991). Other recent finds from W.A. include a possible dinosaur bone from the Miria Formation (saurischian, possibly therepod humerus?) and a possible sauropod caudal vertebra from the middle Jurassic Colalura Sandstone at Bringo Cutting, near Geraldton. The Bringo bone is interesting as only one other Jurassic dinosaur site is known in Australia -the *Rhoetosaurus* site in Queensland. Ichthyosaur, plesiosaur and mososaur bones are occassionally found in the Mesozoic of W.A., although it was only recently found that Late Cretaceous ichthyosaurs are unknown outside of Western Australia. Ichthyosaur vertebrae are now known from the Late Maasstrichtian Miria Formation, and Late Cretaceous (Santonian-Campanian) Molecap Greensand, indicating another chronological anomaly for Australian vertebrate faunas.

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Title: **CRETACEOUS DINOSAUR ICHNOFAUNA FROM BROOME, WESTERN AUSTRALIA.**

By: **John Long.**

Western Australian Museum, Perth.

The Early Cretaceous Broome Sandstone is well known for footprints of the carnosaur *Megalosauropus broomensis* (Colbert and Merrilees 1967). New finds have shown that up to seven different dinosaur ichnotaxa have been identified in the footprint horizon. These include at least two kinds of theropod (one with a much larger central toe), and larger examples of *M. broomensis* with footprints up to 53 cm in length (indicative of a 9 - 10 metre long carnosaur). The ornithopod *Wintonopus* sp., also known from the Late Cretaceous Winton Formation of Queensland, occurs at Broome, as well as other larger, bipedal ornithopods. Large sauropod trackways include individual footprints up to 1.1 metre in diameter, although these are still of doubtful origin due to unclear print definition. Perhaps the most significant find is the very-well preserved prints of a possible stegosaur - a stubby five fingered, assymmetrical manus associated with a three-toed pes. This represents the first possible record of the Superfamily Stegsauria (Family Stegosauridae?) in Australia (Long 1990:67). Due to logistical difficulties, as the footprints can only be studied at extreme low tide, there is much further work to be done on the footprints (including all the casting of new trackways).

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Title: **TIP OF THE PYRAMID?: CRETACEOUS MEGASHARKS FROM AUSTRALIA.**

By: **Susan Turner* and Andrew Rozenfelds.**

Queensland Museum, Brisbane.
*Speaker

New shark remains from upper Albian fragment horizons in the Darwin Member of the Lower Bathurst Island Formation exposed on the shoreline at Nightcliff and Casuarina Beach, Darwin (NT) include two separate large shark vertebrae of the lamnoid type (Applegate 1976), diameters 60 and 64mm respectively. Similar vertebrae (diameter at least 85mm) which includes *'Lamna daviesii'* Eth. fil.1888, a *nomen dubium*, are known from the Lower Cretaceous (Albian) of central

Queensland. Smaller shark vertebrae are known from the Upper Cretaceous of Western Australia (Noel Kemp pers. comm.).

Measurements of the NT and QLD remains compared with those given for Great White Sharks (*Carcharodon carcharias*) (Cailliet *et al.* 1985) suggest that the Albian lamnoid sharks in the Artesian Basin attained lengths of at least five metres and thus constituted top predators.

Other new Albian shark vertebrae from Queensland (being studied by A.R.) indicate the presence of a new type of shark vertebrae not previously recorded from the Mesozoic. These vertebrae superficially resemble those of the squatinoid type but possess an unusual cross-section: lengths of up to three metres are estimated for these sharks. Associated with some of these vertebrae from Canary Station is a beautifully preserved array of shark scales; no such squamation has been found in Cretaceous residues in Australia.

Microfauna from the Darwin Member beds include copious broken bone and a few teeth, possibly of plesiosaur or teleost: macrofauna include siltstone casts of plesiosaur?, wood and invetebrates as outlined by Murray (1985, 1987). Minute dark granules in the rock, which appeared to be bone or phosphate in hand section, appear as dark green rounded aggregates which might be chloritoid.

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Title: **THE DECLINE AND FALL OF THE LABYRINTHODONTIA**

By: **Thomas H. Rich*[1] and Patricia Vickers-Rich[2].**

[1] Museum of Victoria, Melbourne.

[2] Monash University, Melbourne.

* Speaker

Until a decade ago, the commonly accepted view was that the labyrinthodont amphibians became extinct at the end of the Triassic. Since then a number of discoveries in Australia and Asia have extended the range of the group forward in time until now they are known from sediments as young as early Late Cretaceous.

The restriction of this formerly widespread group to Asia and Australia after the Triassic and their subsequent demise there may have been owing to the rise of the Crocodylia at the end of the Triassic. Similar to modern crocodilians in their overall morphology, it is not unreasonable to assume that they might have competed with one another.

Modern amphibians such as frogs are active in snow meltwater whereas crocodilians are not active at water temperatures below about 10°C. This difference in water temperature tolerance would explain the pattern seen in the Jurassic and Cretaceous occurrences of labyrinthodonts in Australia. Located close to the south pole at those times, the water temperatures based on the O^{16}/O^{18} ratio determinations were colder where labyrinthodont remains are found than where crocodilians occur.

The situation in Asia is more complex. There in the Jurassic of the southwestern U.S.S.R., Mongolia and China, crocodilians are found together with labyrinthodonts. Unfortunately, where these joint occurrences have been reported, the crocodilians have not yet been identified below the ordinal level. In the Jurassic of all of Asia, three families of mesosuchian crocodiles have been recognised to date. None are particularly similar to the modern crocodilians nor the labyrinthodonts. If the as yet undetermined mesosuchian remains associated with the labyrinthodonts belong to these three families, then it is quite conceivable that although they occurred together, they did not compete.

Clearly this explanation for the persistence of the labyrinthodonts in the Jurassic and Cretaceous of Australia and Asia will fail if the mesosuchians associated with them are ultimatley found to be similar to them morphologically.

The ultimate demise of the labyrinthodonts may have been owing to the appearance of advanced crocodilians, the eusuchians in the Early Cretaceous together with the thermal maximum for the Phanerozoic that occurred at the boundary between the Early and Late Cretaceous. There simply may not have been any place that the labyrinthodonts could live where the eusuchians could not when the world became a 'Pole-to-pole Jamacia'. If this is so, it can be expected that labyrinthodont remains will never be found in the deposits of Albian age in Victoria when crocodilians occur although they are known from Aptian ones in that State, the Albian being the time of the thermal maximum.

Title: **THE CHIRODIPTERID LUNGFISHES FROM THE LATE DEVONIAN GOGO FORMATION OF WESTERN AUSTRALIA.**

By: **John Long.**

Western Australian Museum, Perth.

The chirodipterid lungfishes were only defined as a monophyletic group last year by Campbell and Barwick, based on the nature and mode of growth of the dentition. A new chirodipterid from Gogo, *Pillararhynchus*, was recently reported from Gogo: this form has a deeper skull, angular lower jaw, long narrow toothplates, and several other differences in the gill arch skeleton and braincase. There are two species of *Chirdipterus* described from Gogo: the common form *C. australis* with dental plates having rounded tooth-ridges, and *C. paddyensis*, based on only two specimens, which have prominent tooth-ridges and deep furrows on the dental plates (Miles 1977). New material from Gogo includes specimens of *Chirodipterus* from a new site (south of Lloyd Hill). In this population, *Chirodipterus* features longer toothplates with dentine on the parasphenoid, all toothplates have prominent narrow ridges rather than blunt rounded tooth rows (despite size), the facet for the mesial ascending process of the prearticular is much smaller, the medial symphysis is slightly larger, the prearticular toothplates may have extensive medial contact; the anterior medial palatal bone is paired, and the braincase shows several minor anatomical differences. Furthermore, the holotype of *Chirodipterus paddyensis* has been further prepared to reveal the palate for the first time: it has a high ridge on the parasphenoid which has a crushing function contiguous with the pterygoid toothplates, and this, along with other differences in the braincase separates it from *Chirodipterus* as a new genus. Finally, the type specimen of *Chirodipterus*, *C. widungensis*, from Germany, has a different dentition from that of the Gogo species, and requires further study to see if the generic identification of the Gogo species is actually valid.

Title: **NEW PALAEOZOIC AGNATHANS (JAWLESS FISHES) FROM CENTRAL AUSTRALIA.**

By: **Gavin C. Young.**

Department of Palaeontology, Bureau of Mineral Resources, ACT.

Two new agnathan occurrences are reported from Central Australia.

1. Devonian. In Australia, until recently, isolated thelodont scales were the only remains of jawless fishes from the Devonian, even though many other groups are well known and diverse in the Siluro-Devonian vertebrate faunas of most other continents. Major groups of armoured agnathans, such as the osteostracans (e.g. *Cephalaspis*) and heterostracans (e.g. *Pteraspis*), which are very diverse in Europe and North America, have been conspicuous by their complete absence. Recently the first armoured agnathans from the Australian Devonian have been described from central Australia

(Young 1991). At least two new genera are present. One may represent a new class of vertebrates. It has an elongate sutureless armour with a long posterior spine and a rostral process, narrow based pectoral fins enclosed in pectoral fenestrae, a large ventral branchial opening, and paired dorsal fenestrae lateral to the orbits. This character combination does not fit readily into any current phylogenetic scheme for known agnathan groups. The second form is poorly known, but possibly belongs with the galeaspid agnathans from the Siluro-Devonian of South China.

2. Ordovician. The two genera of primitive heterostraceans (*Arandaspis* and *Porophoraspis*) were described from the Stairway Sandstone of the Amadeus Basin by Ritchie and Gilbert-Tomlinson (1977). These are the oldest vertebrates (about 465 million years) represented by intact remains so far known. Here I report new microvertebrate faunas from five horizons in the Amadeus Basin sequence, both older and younger than the *Arandaspis* fauna. A micro vertebrate assemblage from the slightly younger Stokes Siltstone includes remains similar to *Sacabambaspis* from Bolivia, and other scales possibly belonging to an early gnathostome. Scales and bone fragments from the top of the Pacoota Sandstone and lower Horn Valley Siltstone may be oldest confirmed vertebrate remains (about 485 million years, early Arenig). These assemblages have proved useful in dating marginal marine deposits in which conodonts are often rare or absent.

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Title: **THE GEOLOGY OF THE CARL CREEK LIMESTONE (RIVERSLEIGH, QUEENSLAND) AND MIOCENE CLIMATE IN NORTHERN AUSTRALIA.**

By: **Dirk Megirian.**

Northern Territory Museum, Darwin.

Mid-Tertiary sediments comprising the Carl Creek Limestone may conveniently be assigned to two distinct, though not unconnected, lithological suites. The Carl Creek Limestone is diachronous, apparently spanning the Miocene. The volumetrically dominant lithological suite is poor in vertebrate fossil remains, and has the characteristics of a type of outwash fan known as an humid alluvial fan. Such fans are formed by perennial streams which during flood events break their banks and become braided streams, sweeping over the fan and reworking older sediments. Factors influencing clastic-carbonate yield, and processes of carbonate deposition, suggest that a carbonate fan could only form under relatively dry, but not arid conditions. The widespread distribution of fluvial and lacustrine carbonates across northern Australia is consistent with this interpretation. The second lithological suite is volumetrically minor, but is yielding a remarkable diversity of vertebrate remains for which Riversleigh is becoming notorious. These sediments may be described as a "tufa association", and were deposited by small, spring-fed streams emerging at a spring-line. Similar sediments are forming today in temperate climates. The mammal fossil record from Riversleigh appears to be biased towards aquatic and rainforest taxa, but it seems likely that a considerably greater habitat diversity was present in the region. Rainforest was restricted to perennial watercourses. The high species-diversity at Riversleigh may be the result of taphonomic processes, whereby relatively numerous, locally-derived, rainforest-adapted forms were augmented by animals preferring mesic conditions. The mesically-adapted forms were obliged to visit sources of permanent water during drier periods to drink: some were fortunate enough to become fossilised. In summary, sedimentological evidence points to temperate, mildly seasonal, and relatively dry conditions across northern Australia during the Miocene.

Title: **EARLY CRETACEOUS FLUVIAL ARCHITECTURE AND VERTEBRATE TAPHONOMY OF THE STRZELECKI AND OTWAY GROUPS, SOUTH-EASTERN AUSTRALIA.**

By: **A. Constantine*[1], P.V. Vickers-Rich[1]. T.H. Rich[2] and R.A.F. Cas[1].**

[1]Department of Earth Sciences, Monash University, Victoria.
[2]Museum of Victoria, 285-321 Russell St., Melbourne.
* Speaker

The concentration and preservation of local and/or regional components of a prevailing ecosystem is ultimately controlled by the sedimentary and stratigraphic architecture of the prevailing depositional system. Early Cretaceous fluvial sediments of the Otway and Strzelecki Groups have yielded a diverse vertebrate fauna including turtles, fish, birds, lepidosaurs, pterosaurs, plesiosaurs, and labyrinthodont amphibians. The most notable disparity in the biotic compositions between the two basins is the presence of a fairly large number of labyrinthodont amphibian bones (30 out of 118) from the Strzelecki Group, while none have yet been found in the Otway Group from more than 2000 bones recovered. Sedimentological and architectural element analysis of more than 70 bone localities from both the Otway and Gippsland Basins indicates that the bone distribution is strongly sedimentologically/stratigraphically controlled, and that some lithofacies and architectural elements are more prospective than others.

?Barremanin-Aptian tetrapod-bearing sites between San Remo and Kilcunda in the Gippsland Basin accumulated in both active and inactive tracts of a variably-sinuous, multi- to single-channel, mobile sheet fluvial system with both lateral accretion and downstream accreting macroforms. Channel pattern changes are due to (1) periodic oversupply of volcanogenic sediment, and (2) regular flooding. Architectural elements conductive to concentration and preservation of bones within active tract settings include SG (sedimentary gravity flows), GB (gravelly bedforms), LS (sheeted laminated sand), and sandy bedforms (SB) lining the base of channels (CH). Less prospective elements include DA (downstream accreting macroforms), LA (lateral accretions), and OF (overbank fines). Bone-bearing lithofacies in active channels are typically abundant in intra- and extraformational clasts, and/or carbonaceous fragments. The preservation of bone in active channel settings is due to a combination of flooding and rapid burial. Two mechanisms are evident; (1) rising flood waters, sweeping over vegetated islands and exposed bar surfaces, concentrating the debris along the channel floor where they are quickly covered by lower and upper flow regime bedforms, and (2) bank collapse during falling stage initiating mass/debris flows (SG) into the central channel. The excellent preservation of metre-long jaw-bones, and clavicles with attached anterior processes, within massive sands (lithofacies SM/Element SG) attests to the rapid burial and preservation potential of mass flows. Bones recovered from inactive tract settings occur immediately above the basal erosional surface of distributary channels (CH/SB) incising into thick floodplain deposits. Violent flooding associated with channel avulsion, is responsible for concentrating bone and carbonaceous debris littering the floodplain surface into the central channel scour. The presence of bones within active channel sequences dominated by flood events and high-energy lithofacies suggest that mortality may have occurred by both attritional and catastrophic means.

Late Aptian-Early Albian tetrapod-bearing sites at Dinosaur Cove accumulated within an inactive tract of a broad, low-sinuosity, multichannel, mobile-sheet fluvial system dominated by downstream accreting macroforms. Abundant bone fragments have been recovered from the base of small, active channels (CH) and sheeted sands (LS), locally scouring into levee, pond, vegetated island and floodplain sediments. The occurrence of four significant bone localities within this inactive tract sequence suggests that vegetated islands and floodplains were a habitat for the vertebrates with food, shelter and water readily available. Many of the bones probably accumulated in a dry-overbank setting prior to flooding which swept the inactive channel surface clean and concentrated the debris in shallow channels or low-lying areas such as ponds and abandoned water courses. The recovery of a small, well preserved hypsilophodontid skull within pond sediment indicates that at least some mortality occurred in a sub-aqueous wet-overbank setting.

The spatial distribution of labyrinthodont bones appears to be strongly sedimentologically and stratigraphically controlled by the San Remo Member, a basement-derived, distal alluvial fan/active channel sequence approximately 200 m thick, which is restricted to the southwestern corner of the Gippsland Basin adjacent to the downthrown side of a basin-margin growth fault active during the ?Barremian-Aptian. Periodic, localised displacement on the basin-margin fault produced fault scarps which shed granitic and metasedimentary detritus, via alluvial fans, into active tracts transporting large amounts of volcanogenic sand. Lithofacies associated with labyrinthodont bones indicate fairly high-energy active channel accumulation, with the majority of them occurring in Element SG and along Element CH bounding surfaces characterised by abundant extraformational grit and conglomerate. These high-energy lithofacies are absent from Dinosaur Cove in the Otway Basin, although they are present elsewhere in the Gippsland Basin minus the extraformational detritus. This may explain the absence of layrinthodont remains from other major bone localities in the Otway and Strzelecki Groups without needing to invoke extinctions as a possibility for their absence in the fossil record. Labyrinthodonts appear to have inhabited the margins of the rift valley on the distal edges of basement-derived alluvial fans which drained into active channels heading longitudinally down the rift-basin.

The absence of labyrinthodont remains from Dinosaur Cove and elsewhere in the Otway Basin, suggests that by Late Aptian-Early Albian times, (1) basement highs were either no longer exposed in the Otway Basin, or (2) Dinosaur Cove was situated in a more medial position in the rift-valley and extraformational detritus effectively by-passed it, or was broken down by transport and diluted by the large volume of sediment transported by the active channels, or (3) suitable outcrops are simply not exposed or preserved.

Title: **TIRARI FORMATION AND CONTAINED FAUNAS, PLIOCENE OF THE LAKE EYRE BASIN, SOUTH AUSTRALIA.**

By: **R.H. Tedford *[1], R.T. Wells[2] and S.F. Barghoorn[1].**

[1]American Museum of Natural History, New York.
[2]Flinders University South Australia, Adelaide.
* Speaker.

First recognized in the southeastern Lake Eyre Basin, S.A., and typified at Lake Palankarinna, the Tirari Formation has subsequently been traced northward to outcrops along the lower Warburton River. Unfossiliferous red gypsiferous mudstone with interbedded cross-laminated gypsum sand is the most characteristic lithology, but a basal stream channel fill at Lake Palankarinna, the Mampuwordu Member, contains the Palankarinna Fauna, and a widespread nested sequence of channel fills at the top produces the Toolapinna and Kanunka faunas. These faunas are dominated by extinct species and contain diprotodontid and macropodid genera not found in Pleistocene or Recent assemblages. They differ from older Tertiary faunas in that their taxa are more closely related to living or Pleistocene clades. The Kanunka and Toolapinna assemblages contain *Euryzygoma*, *Prionotemnus*, *Protemnodon devisi* and conilurine rodents in common with Pliocene faunas elsewhere in Australia. The presence of conilurine rodents provides a maximum age of 4.4 Ma for the upper part of the Tirari Formation. Magnetostratigraphic studies indicate that the Tirari Formation is largely reversed in the polarity, but contains normal intervals at and near the base at Lake Kanunka and the lower Warburton. Faunal evidence suggests correlation of the Tirari Formation with the younger part of the Gilbert Chron (4.2 -3.4 Ma) the older intervals representing the Nunivak and Cochiti subchrons.

Title: **THE CURRAMULKA LOCAL FAUNA: A NEW LATE TERTIARY FOSSIL ASSEMBLAGE FROM YORKE PENINSULA, SOUTH AUSTRALIA.**

By: **Neville Pledge.**
South Australian Museum, Adelaide.

Joint controlled caves have been known at Curramulka on Yorke Peninsula since the earliest days of settlement, and one of them has yielded late Pleistocene and Holocene fossil vertebrates. Until recently, only modern bones had been found in the other cave. Now, the discovery of fossil bones in the unflushed core of the Corra Lynn Cave has revealed a rich and diverse vertebrate fauna, numbering at least 27 species, most of which are marsupials. A preliminary list is given. Few taxa can be positively identified beyond the generic level, and there are at least two new species, notably a giant koala and a giant ringtail. The overall faunal composition, combined with the absence of murid rodents suggests an early Pliocene, even late Miocene age.

Title: **THE TINGAMMARRA LOCAL FAUNA. EARLY TERTIARY VERTEBRATES FROM SOUTHEASTERN QUEENSLAND.**

By: **Henk Godthelp*, Michael Archer, Suzanne Hand and Lyn Sutherland.**
School of Biological Sciences, University of NSW.,
*Speaker.

A diverse assemblage of vertebrate remains is being recovered from clays at the base of Boat Mountain near Murgon in southeastern Queensland. Radiometric techniques applied to a superpositional basalt and to the clays support at Paleocene/Eocene age for the fauna. The mammal assemblage is a curious mix of plesiomorphic and autapomorphic taxa with no undoubted affinities to other groups. Overall preliminary assessment of continental affinities suggest most similarities with the Australian biota. The high degree of endemicity evident at this time is unexpected and suggests a more ancient and perhaps more complex origin for the Australian mammal fauna.

Title: **THE ALCOOTA AND BULLOCK CREEK LOCAL FAUNAS.**

By: **Peter F. Murray*[1] and D. Megirian[2].**
[1]Northern Territory Museum, Alice Springs.
[2] Northern Territory Museum, Darwin.
*speaker

New fossil material and some taphonomic and palaeoecological observations on the Alcoota and Bullock Creek Local Faunas are presented. Both localities suggest that seasonal climatic changes occurred. The Alcoota deposit may represent an extreme climatic event.

Title: **THE LIMEBURNER'S POINT LOCAL FAUNA**

By: **William D. Turnbull *[1], Ernest L. Lundelius, Jr[2]., and Richard H. Tedford[3].**
[1]Field Museum of Natural History, Chicago.
[2] Department of Geological Sciences, University of Texas, Austin.
[3]American Museum of Natural History, New York
*Speaker.

A collection of fossil marsupials, recovered from freshwater limestones at Limeburner's Point near Geelong, Victoria, Australia is described. The fauna, here named Limeburner's Point Local Fauna, contains *Sarcophilus*, a large vombatid, *Diprotodon "longiceps"* McCoy, *Diprotodon* sp., *Sthenurus Simosthenurus) orientalis*, at least one large macropod near *Macropus* and a small

wallaby. Most of these taxa belong to extinct lineages. The faunal assemblage indicates a mid-Pleistocene age which is in accordance with recent conclusions based on magnetic polarity stratigraphic analysis and earlier stratigraphic correlations.

Title: **UPDATE ON STAIRWAY SANDSTONE VERTEBRATES.**

By: **Alex Ritchie.**

Australian Museum, Sydney.

No abstract received.

Title: **FOUR NEW CROCODILIANS FROM EARLY MIOCENE SITES AT RIVERSLEIGH STATION, NORTHWESTERN QUEENSLAND.**

By: **Paul M.A. Willis.**

School of Biological Sciences, University of NSW.

Skull and mandible fossils from White Hunter Site, Riversleigh, northwestern Queensland, indicate the presence of four new species of crocodile, one of which can be shown to be present in other sites at Riversleigh. These four species can be shown to belong to previously described genera (*Mekosuchus, Quinkana* and *Baru),* all of which were previously monotypic. Thus all three genera have had to be redefined. A phylogenetic analysis of these new forms lends support to the hypothesis of a Tertiary radiation of crocodilians in Australia. (Willis *et al.,* 1990) but the lack of synapomorphic features casts doubts on the monophyly of these forms.

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